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(54) **Electric rotary-blade knife**

(57) The electric rotary-blade knife is particularly suitable for slicing meat or other food products, comprises an elongate chamber (1) that is used as a handle and is provided externally with a button (6) for operating an electric motor (5) mounted longitudinally inside this handle and that drives a spindle whose shaft ends at one end of this handle and is designed to accept, keyed to it removably, a rotary blade (11) mounted in front of a casing (14) fixed removably to said handle (1), to protect a large section of the circumference of said blade and to leave exposed another section of it, where, along this exposed part of the blade, there is provided for example tangentially a guide (25) whose distance from said blade is adjustable, to allow the depth of the cut to be adjusted and therefore to enable the knife to cut slices of meat of adjustable and desired thickness, to which motor power may be supplied via the connection to a power lead (4) or to rechargeable electric batteries inside said handle (1). The said casing (14) is fixed to said handle (1) by a quick attachment such as a bayonet attachment.

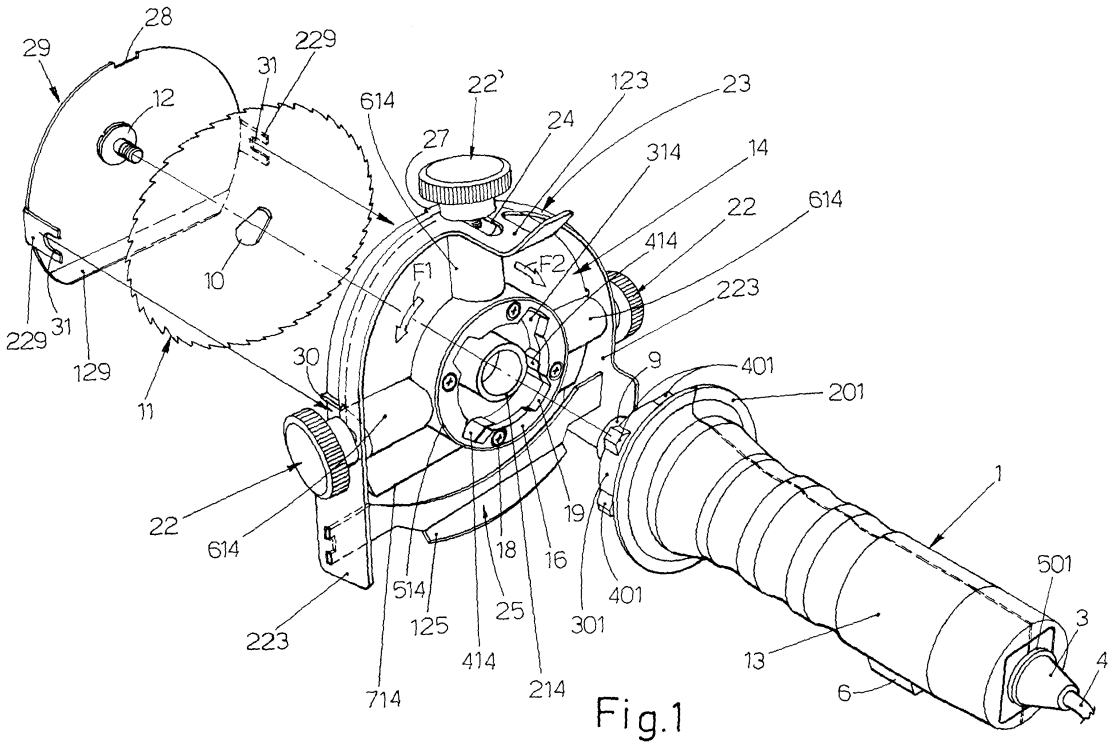

Fig.1

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Description

[0001] The invention relates to electric rotary-blade knives that are particularly suitable for slicing meat or other food products, such as roasted meat of the type known as chicken or turkey kebab, gyros, shoarma and donner or western products such as cured meats, cheeses, etc.

[0002] The prior art presents electric rotary-blade knives for the use indicated above. The patents and patent applications GB 2,346,798, DE 201 00 577 U1 and EP 1,787,768 disclose one of these knives provided with an elongate chamber that is used as a handle, that is provided externally with a button for operating an electric motor mounted longitudinally inside this handle and that drives a spindle whose shaft ends at one end of said handle and is designed to accept, keyed to it removably, a rotary blade mounted in front of a casing fixed to said handle, which protects for example about 240° of the circumference of the blade and exposes the rest of the angular amplitude of the blade, where, along this usable part of the blade, there is tangentially an idle wheel and/or a foot that form a guide whose distance from said blade is adjustable, that is made to slide along the product, and that is used to adjust the depth of cut of said blade and consequently allow slices of product of adjustable and desired thickness to be cut. A power lead usually passes out of the other end of said handle for connection to power supply means for said electric motor.

[0003] In the device indicated above, the casing is fixed with no less than four or six screws to one end of said handle. This means that, while it is easy to dismantle the blade and clean it, since all that is required is to unscrew the single axial fixing screw, it becomes difficult to dismantle said casing and said depth-of-cut adjustment guide, and as a result these components are often cleaned in connection with said handle, into which some of the cleaning liquid may penetrate, possibly damaging the motor and/or other internal electrical parts.

[0004] Also known is the rotary-blade knife described in patent GB 2,336,192, where said casing is fixed to a spindle, to the shaft of which the blade can be removably keyed, and the body of which is designed to be coupled and uncoupled quickly to and from said handle by simple actuation of a button which deactivates an axial locking mechanism. The bearing-mounted shaft of the spindle is designed for quick coupling to the electric motor, which is housed in the knife handle, by a prism-shaped engagement. This construction obviates the serious drawbacks of the constructions described above in that it makes it possible to uncouple quickly from the motor said spindle with the casing, blade and depth-of-cut adjustment guide, and clean only these mechanical parts. However, these parts have bearings and many cavities, including those of the female part of said prism engagement, where dirt can remain. It is therefore difficult to clean them properly by washing them in a dishwasher as they would be exposed to high temperatures and to the chemical action of the detergents which could quickly damage the elastomer seals of the spindle bearings, which would allow the lubricant to leak out and create a risk of contamination and mechanical seizing. Added to these disadvantages is also the fact that during use of the knife, dirt may enter the handle through the seat from which projects the button for deactivating said axial locking mechanism of the spindle.

[0005] It is an object of the invention to obviate these and other disadvantages of the prior art by means of a rotary-blade knife according to Claim 1 and subsequent dependent claims, which makes use of the following idea for a solution. The spindle with the bearing is mounted in the knife handle and is permanently connected to the electric motor. From one end of the handle there projects axially the shaft of the spindle which engages leaktightly with the inner ring of the bearing, which in turn possesses, directed outwards, the seals between this inner ring and the outer ring, which in turn is fixed leaktightly in said handle. This end of the handle is shaped in such a way that it can be fixed by a quick removable connection, for example a bayonet attachment, to a corresponding seat in the rear of the casing which possesses axially a hole through which there passes the spindle shaft which projects from the front face of this casing in the form of a part designed to accept, keyed, with a non-round coupling cross section, using a screw for fixing, the centre of the rotary blade. Once the blade is removed, by a quick and simple uncoupling action, said casing can be disconnected from the knife handle, and said casing and the blade can be washed even in a dishwasher. The casing is designed to support, adjustably and removably, both a guide for adjusting the depth of cut of the blade, and a front cover for protecting the inactive part of said blade, in order that these components can easily be dismantled and washed periodically.

[0006] Other features of the invention, and the advantages procured thereby, will become clearer in the course of the following description of a preferred embodiment, illustrated purely by way of non-limiting example, in the figures of the attached sheets of drawings, in which:

- Fig. 1 is a perspective view of the rotary-blade knife, seen from behind and above and disassembled into its various components;
- Fig. 2 shows the front of the knife in the use condition, in section on a plane which contains the blade's axis of rotation;
- Fig. 3 is a front end view of the knife handle;
- Fig. 4 is a rear end view of the casing with part of the central seat allowing it to be quickly and removably fixed to the front end of the knife handle;
- Fig. 5 is a front view of a ring which is fixed to said central rear seat of the casing seen in Figure 4, to complete it in its function as a female part of the bayonet coupling, suitable for housing the corresponding male part formed on the front end of the handle, as seen in Figure 3; and

- Fig. 6 is an end view of the ring seen in Figure 5, mounted on the seat seen in Figure 4, engaging with the end of the handle seen in Figure 3, which is indicated in dashed lines.

[0007] As can be seen in Figures 1 and 2, the knife according to the invention comprises an elongate cylindrical round-section handle 1 made up of two mating shells of a suitable plastic material fixed together by a suitable number of tangential screws 2 suitably distributed and fixed in corresponding seats 101 moulded into said shells. The handle 1 has an enlarged collar 201 at the end near the cutting blade, as a safety and endstop for the user's hand, and beyond this collar the handle 1 terminates with a smaller-diameter cylindrical plug 301, on whose outside are one or more radial teeth 401 which, when viewed end-on as in Figure 3 and sideways as in Figure 2, are each seen to be an isosceles trapezium with a profile useful for the function they are to perform, as will be explained later. At the other end of the handle 1 is a hole 501 (Fig. 1) for the sealed accommodation of a rubber cable gland 3 which carries leaktightly the power lead 4 for supplying the electric motor 5 (Fig. 2) housed axially in the same handle 1 and which may be operated via a normally open button 6 mounted in a side opening in this handle 1. The knife according to the invention must be understood to be protected even in a possible version with rechargeable electric batteries inside the handle 1 designed for recharging when the knife is at rest and on a cradle.

[0008] Before joining together the two shells which form the handle 1, a spindle is installed inside them. This spindle comprises, keyed and fixed, for example by a grub screw 7, to the shaft 105 of said motor 5, an auxiliary shaft 9 which passes accurately and with lateral leaktightness through the inner ring of at least one self-lubricating bearing 8, e.g. a ball bearing, precision-mounted with lateral leaktightness in an inside seat 601 in the handle 1 (Fig. 2), the length of said shaft 9 being such that it projects to a suitable distance out of the front end of the handle 1, with a small relief portion 109 which, viewed end-on as in Figure 3, is of a non-round shape such that by mounting the corresponding central hole 10 in the cutting blade 11 (Fig. 1) on it and screwing a screw 12 into a threaded hole 112 in said relief 109, said blade can be fixed axially and keyed to said shaft 9. When all of these components have been assembled, the two shells forming the handle 1 are joined together and an elastomeric sheath 13 is placed tightly around the handle 1. The sheath ends a short distance before the collar 201, closing the through holes of the screws 2 and, by its softness and external shape which is partly in relief and partly sunken, makes the handle ergonomic and nonslip and therefore safe in use. In a preferred but not limiting embodiment of the invention, the button 6 may be mounted on the handle 1 in such a way that it does not significantly project from it, before the sheath 13 is put on the handle, and as a result is covered and protected by this elastic sheath 13.

[0009] Figures 1, 2 and 4 show at 14 the casing that is to be attached to the handle 1, which is in the form of a sector of a circle, with an amplitude of approximately 240° and with a diameter greater by a suitable amount than the diameter of the actual blade, so that the linear cutting edge 714 of this casing leaves the blade 11 exposed for a corresponding portion of approximately 120°, whereas the casing protects the rest of the blade not only end-on but also by having a peripheral collar 114. The casing 14 has on the face directed towards the handle 1, and in one piece, an axial bush 214 with an inside diameter able to take, with sufficient radial play, said motorized secondary shaft 9 and, outside of this bush, the same casing 14 supports concentrically and in one piece another bush 314 with a number, for example four, of enlarged internal parts 414 at equiangular intervals, each containing a blind threaded hole 15. This latter bush 314 has a raised peripheral collar 514 in which a ring 16 can be mounted as in Figure 5, this ring having four holes 17 at equiangular intervals which line up with corresponding holes 15 in said bush 314 so that the ring 16 can be fixed to said bush by means of corresponding screws 18, as illustrated in Figure 6. The ring 16 is of a width such as to cover said internal enlargements 414 of the bush 314 and has four internal recesses 19 at equiangular intervals, which in shape and dimensions are slightly larger than the end-on shape and dimensions of the teeth 401 on the end of the handle 1. The casing 14 may be made as an injection-moulding in a plastic suitable for food use, like the ring 16. The inside diameter of the ring 16 is slightly greater than the outside diameter of the end plug 301 of the handle 1, in such a way that this plug 301 can be inserted into this ring 16 until it meets the casing 14, after which, by rotating the casing (and/or the handle) in a direction indicated by an arrow F1 shown on the rear face of the casing (Fig. 1), the user inserts the reliefs 401 on the end of the handle with slight force behind the wider sections of the ring 16, until stopped by the enlargements 414 and in this way the handle is securely fixed to the casing 14. As shown in Figure 5, the lower face of the ring 16 may contain, at a short distance from the holes 17, small recessed indentations 20 to reduce the interference between the reliefs 401 and this ring 16 at the end of the connecting travel of the handle and to give the user a "click" feel indicating correct execution and completion of the engagement. For the same purpose, the reliefs 401 may have incisions perpendicular to the axis of the handle 1, to create springy portions designed for acting on said ring 16. These latter details have not been illustrated in the drawings as being obvious and easily carried out by those skilled in the art purely on the basis of the description supplied.

[0010] It will be obvious from Figure 2 that once the handle 1 is fixed to the casing 14, the edge of the bush 514 of this casing presses with a good seal against a corresponding annular end seat in the handle, preventing any dirt getting into the bayonet coupling which can easily

and quickly be released by twisting the casing 14 in the reverse direction to that described earlier for assembly, as indicated by the arrow F2 depicted on the rear face of this casing (Fig. 1).

[0011] Figures 1, 2 and 4 show that on the rear of the casing 14 are three enlarged parts 614 in a radial arrangement, at angular intervals of ninety degrees, such that two of these enlargements are in axial alignment with each other, lying parallel to the linear edge 714 of the casing 14, with internally threaded metal bushes 21 embedded in these enlargements. Screws 22 are screwed into these bushes with knurled external heads for easy actuation. The mutually opposing screws 22 pass through holes in the end part of a flat stainless steel arch 23, in the middle of which is a slot 24 in which the corresponding screw 22' sits and which is formed in an appendage 123 perpendicular to the arch, extending towards the handle 1 and ending in an upward portion to enable it to be easily pulled and/or pushed by a finger of the user's hand. When the screws 22 and 22' are tightened up, the arch 23 is locked in the desired position. On the other hand, when at least screw 22' is slightly slackened off, said appendage 123 can be moved to pivot the arch 23 about the fulcrum screws 22, thereby modifying the position of this arch in order to adjust the thickness of the slice of product which the knife is to be able to cut. Thus, Figures 1 and 2 show that the arch 23 extends beyond the fulcrum screws 22, with corresponding mutually parallel straight sections 223, which are suitably shaped to also correctly guide the cut slice of product. Fixed to these parallel straight sections 223 by its ends is a foot 25 with a terminal section 125 shaped to assist engagement by being bent towards the handle 1, which as shown in Figure 2 is designed to slide against the product P to be cut, so as to give a predetermined limit to the depth of insertion of the blade 11 into the product. By modifying the position of the arch 23 by the adjustment described above, which may advantageously be done even when the device is in use, it is possible to adjust the distance of the foot 25 from the blade 11 and therefore it is possible to adjust the thickness of the slice of product P cut by this blade. It will be understood that the foot 25 illustrated here, made from sheet stainless steel, can be replaced by any other suitable means, such as a stainless steel round bar or roller.

[0012] As can be seen in Figure 2, at least the intermediate part of the arch 23, which is designed to engage with the screw 22' and which includes said appendage 123, has a curved generatrix whose centre of curvature is on the fulcrum screws 22, and that this same curved part engages with a relief of mating curvature 26 on the outer lateral surface of the casing 14. This is so that when the screw 22' is tightened as far as it will go, the arch 23 will lock by friction on said relief 26, as clearly shown in Figure 2. The same Figure 2 and Figure 1 also show that at the site of said relief 26 the casing 14 has a transverse relief 27 which engages in a corresponding recess 28 in a small stainless steel cover 29 that bears on the forward edge of the lateral protective surface of said casing 14, has an oblique lower part 129 extending almost far enough to touch the blade 11, and is provided with perpendicular and diametrically opposite appendages 229 that fit into corresponding guide seats 30 in the casing 14 (Figs 1, 4) and that have slots 31 to accept the shanks of the screws 22 which when tightened up also securely fix the cover 29 in use. Figures 2 and 4 show, at 814, a small relief edge on the front face of the casing 14, parallel to and alongside the linear cutting side 714 of said casing, to act as a "scraper" for the rear face of the blade 11, to prevent the accumulation of excessive residues of product between the casing and the blade, which could drag on the blade and increase the load on the electric motor 5, overheating it and damaging it.

[0013] The advantages of the rotary-blade knife as described will be obvious. The use of the bayonet attachment formed by the plug 301 with the end teeth 401 on the handle 1 and the seats 314, 16, 19 in the casing 14, makes it possible to fix and disassemble the handle 1 quickly to and from the casing 14. To dismantle it, the user must first remove the cover 29, then unscrew the blade 11 fixing and keying screw 12 to remove this blade, after which the handle 1 can be removed from the casing 14 and all the parts that have worked in contact with the product P can be washed even in a dishwasher. All the blade 11 supporting and rotating parts remain, however, sealed inside the handle 1 and in this way can be protected against all damage. The operation of assembling the knife is equally simple, quick and secure. The advantage of the convenience and speed of adjustment of the distance of the foot 25 from the blade 11 to modify the thickness of slices of product being cut has already been pointed out. Finally, it will be understood that the description has been given with reference to a preferred embodiment of the invention, to which numerous alterations and modifications may be made, especially from the point of view of construction. Such changes may for example relate to the fact that the components of the bayonet attachment may be of a different shape from those illustrated and/or that the female part of the attachment may be connected to the handle 1 in a different manner, while the male part of the same attachment may have a different connection to the casing 14, with the advantage of easier cleaning of the parts requiring periodic washing.

Claims

1. Electric rotary-blade knife, particularly for slicing meat or other food products, of the type that comprises an elongate chamber (1) that is used as a handle and is provided externally with a button (6) for operating an electric motor (5) mounted longitudinally inside this handle, to which power may be supplied by any suitable means, and that drives a spindle whose shaft ends at one end of said handle (1) and is designed to accept, keyed to it removably,

a rotary blade (11) mounted in front of a casing (14) fixed removably to said handle (1), to protect a large section of the circumference of said blade and to leave exposed another section of it, where, along this exposed part of the blade, there is for example tangentially a guide (25) whose distance from said blade is adjustable, to allow the depth of the cut to be adjusted and therefore to enable the knife to cut slices of meat of adjustable and desired thickness, said knife being **characterized in that** said casing (14) is fixed to said handle (1) by a quick attachment such as a bayonet attachment.

2. Electric knife according to Claim 1, in which said spindle to which the rotary blade (11) is keyed comprises a shaft (9) keyed at the rear to said electric motor (5) and supported rotatably and leaktightly by at least one self-lubricating bearing (8) and with seals, its outer annulus being mounted leaktightly inside said handle (1), wherein this shaft (9) of the spindle projects axially from that end of the handle (1) which is designed for the removable fixing, by a quick attachment such as a bayonet attachment, to the central part of said casing (14), said handle (1) having an axial hole (214) for the passage of said shaft, whose end projecting from the forward face of said casing is provided with any suitable means (109, 112) to accept, keyed and fixed by for example a screw (12), a rotary blade (11) with a smooth or saw-toothed edge having an axial hole (10) of a shape suitable for engagement with said fixing and keying means (109, 112, 12).

3. Electric knife according to the preceding claims, in which the quick bayonet attachment comprises a male part formed on either of the two parts that are to be joined together, for example on the end of the handle (1), and formed by a cylindrical plug (301) with one or more radial teeth (401) and comprises, axially on the rear of said casing (14), a female part which has a cylindrical seat (314, 16) suitable to be engaged by said end plug (301) of said male part, and which has radial openings (19) in which the radial teeth (401) of said male part can be inserted, and which also has transverse containment walls (16) behind which said teeth (401) can be inserted with friction, following a relative rotation between the handle and the casing, until they meet endstop enlargements (414), said female part of the bayonet attachment being provided with an axial bush (214) suitable to accept with play said spindle shaft (9), to the end of which the cutting blade (11) is then keyed.

4. Electric knife according to Claim 3, in which said female part of the bayonet attachment is made up of two parts, specifically: an outer bush (314) having internal enlargements (414) with threaded holes (15) to allow screws (18) to be used to fix to this bush, coaxially with this bush, a ring (16) having an inside diameter such as to allow the passage of the plug (301) of said male part of the attachment and having radial openings (19) to allow the passage of the radial teeth (401) of said male part of the attachment.

5. Electric knife according to Claim 4, in which said ring (16) forming the undercut parts of the female part of the bayonet attachment may be provided, on its face that is not in view, with recessed indentations (20) to reduce the friction between said ring and the teeth (401) of the male part of the attachment when these teeth reach the locked end-of-travel position of said bayonet attachment.

6. Electric knife according to Claim 4, in which the teeth (401) of the male part of the bayonet attachment may have incisions in order to give properties of flexibility and elasticity to that part of these teeth which is intended to engage with said ring (16) of the female part of the bayonet attachment.

7. Electric knife according to one or more of Claims 3 to 6, in which the female and composite part of the bayonet attachment is formed on the end of the handle (1), while the male part of this attachment is formed axially on the rear face of said casing (14).

8. Electric knife according to one or more of the preceding claims, in which the casing (14) is provided at the rear with radial enlargements (614) with threaded seats (21) into which to screw, from the outside, screws (22) with heads whose shape facilitates manual actuation, two of these screws (22), opposing one another, being suitable for pivoting at the sides of the casing the ends of an arch (23) passing around the peripherally closed section of said casing and extending past that part (714) where the casing leaves the blade (11) exposed, in the form of mutually parallel sections (223) which support the guide (25) or other suitable means that is caused to slide along the product (P) which is to be cut, in order to limit the depth of cut of the blade and thereby the thickness of the resulting slice of product, for which purpose said arch (23) is provided with an intermediate and perpendicular appendage (123) with a longitudinal slot (24) to accept the shank of a tightening screw (22') which is screwed into the intermediate one of said enlargements (614), in such a way that by acting on this appendage (123) it is possible to modify the position of said arch (23) and adjust the distance of said guide (25) from the cutting blade (11).

9. Electric knife according to Claim 8, in which the casing (14) is provided, adjacent to said appendage (123), with a convex relief (26) that acts on a corresponding curvature of said appendage (123) and of

said arch (23), to support the latter and to oppose the tightening action of said screw (22').

10. Electric knife according to one or more of the preceding claims, in which the casing (14) is provided, in the intermediate and forward part of its peripheral edge, with a relief (27) that mates with a corresponding recess (28) in a small cover (29) that bears on the forward edge of the lateral protective surface of said casing (14), has an oblique lower part (129) extending almost far enough to touch the blade (11), and is provided with perpendicular and diametrically opposite appendages (229) that fit into corresponding guide seats (30) in the casing (14) and that have slots (31) to accept the shanks of said two opposing screws (22), which when tightened up also securely fix the cover (29) in use.

11. Electric knife according to one or more of the preceding claims, in which the front face of the casing (14) has, parallel to and alongside the linear edge (714) of said casing, a small relief edge (814) that acts as a "scraper" for the rear face of the blade (11).

12. Rotary knife according to the preceding claims, in which all parts intended to have contact with the product, including the blade (11), the front cover (29) and the arch (23) with its guide (25), are made of stainless steel, while the casing (14) with the various components forming the female (or male) part of the bayonet attachment is preferably made of a plastic material that is also suitable for food use.

13. Rotary knife according to Claim 1, in which arrows (F1, F2) and inscriptions are provided on the rear surface of the casing (14) to indicate the direction of rotation to be given to said casing while keeping the handle (1) stationary, in order to engage or disengage these two parts of the knife with respect to each other.

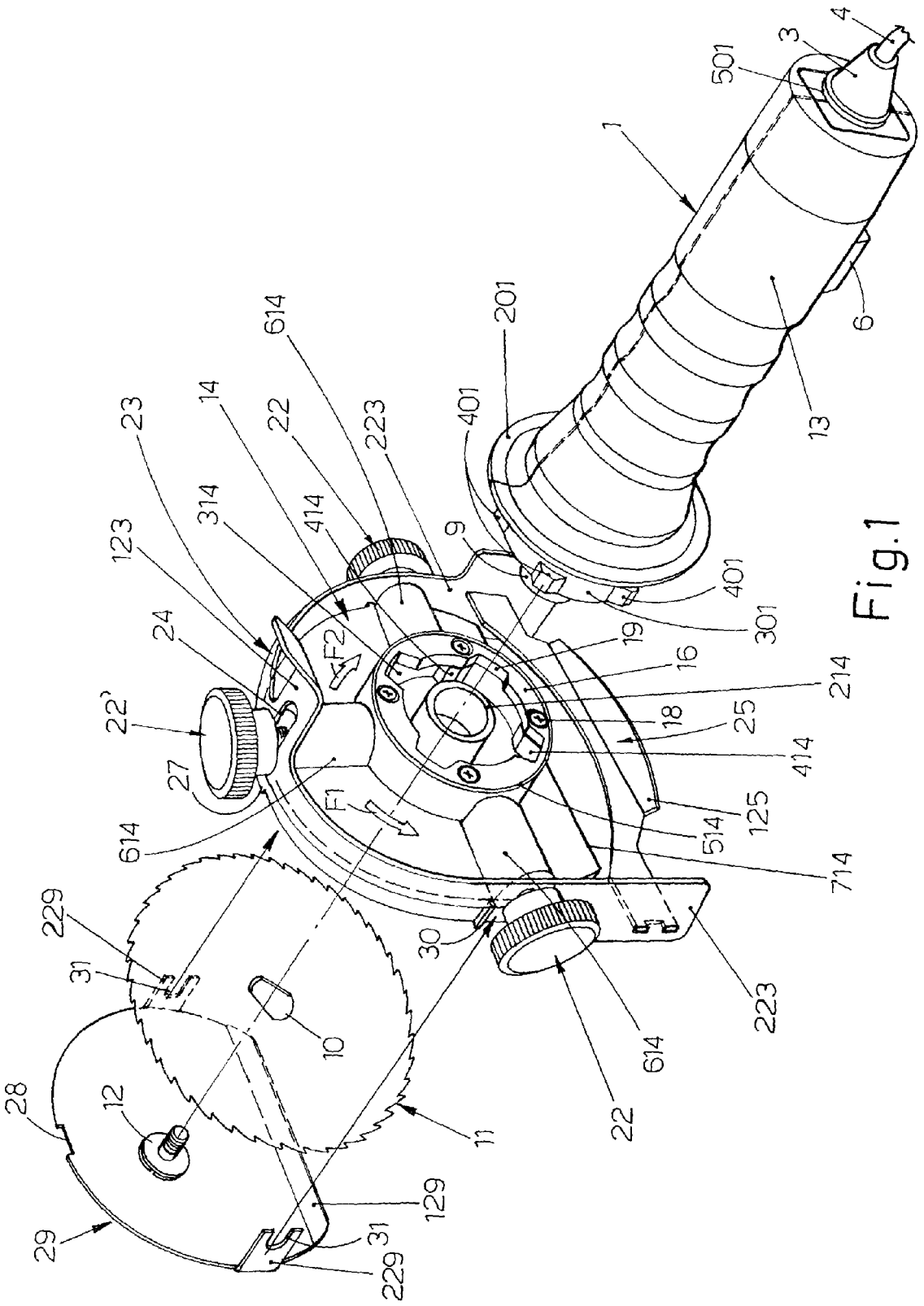
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Fig.1

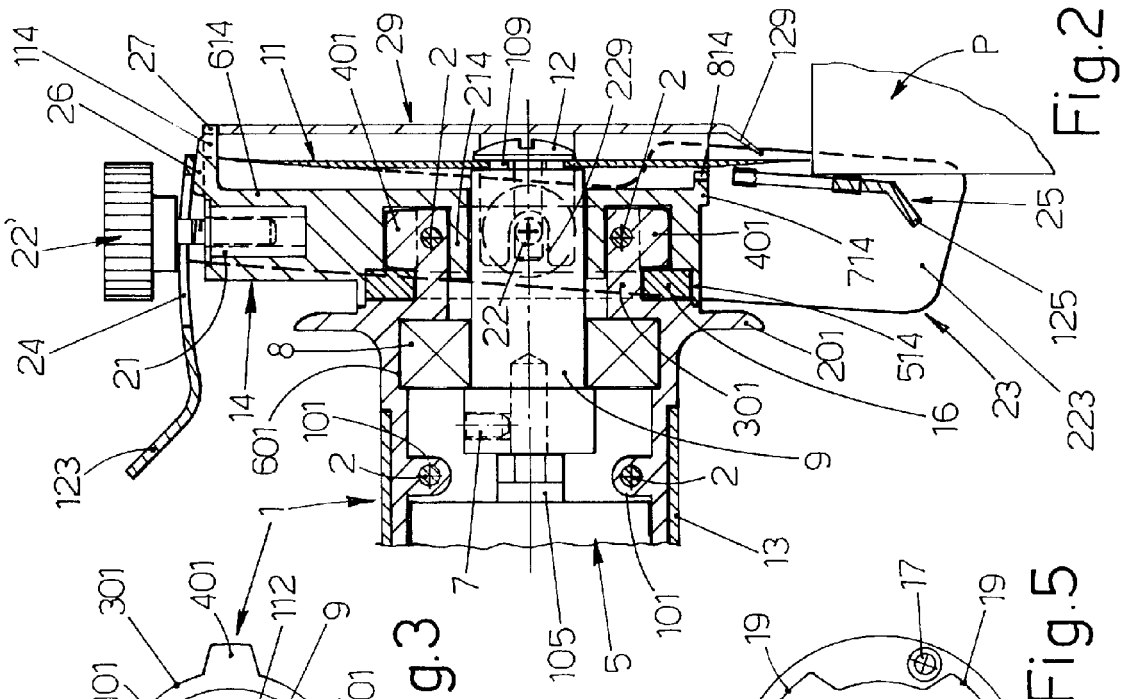

Fig.2

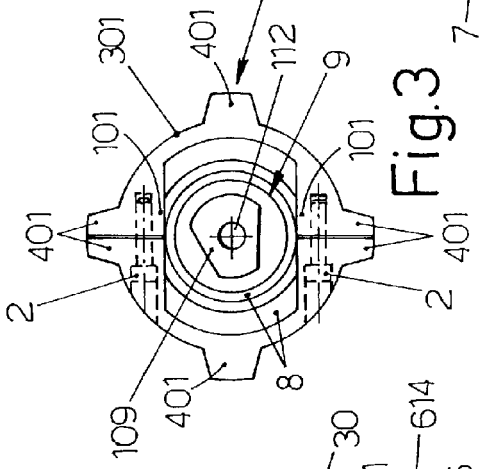

Fig.3

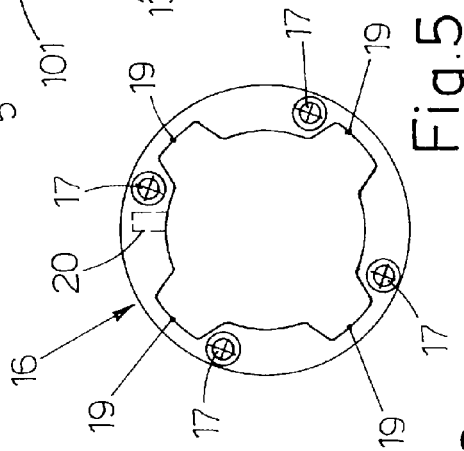

Fig.5

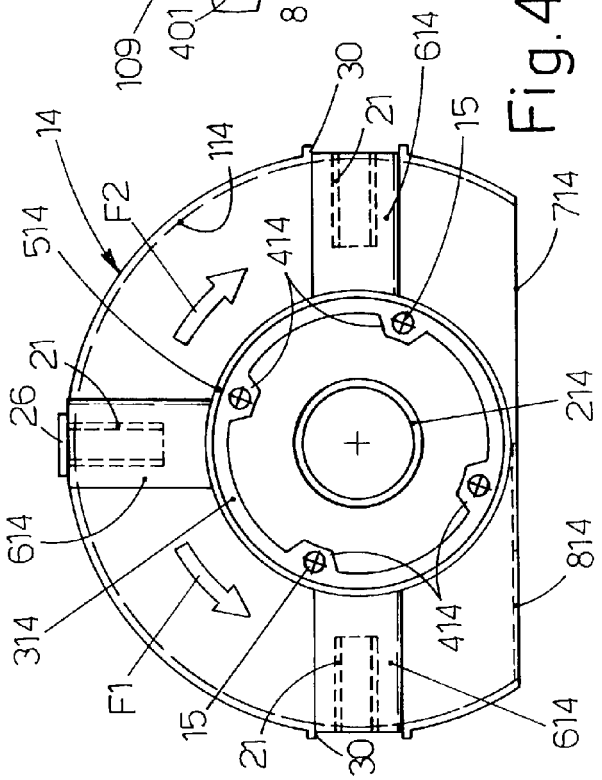

Fig.4

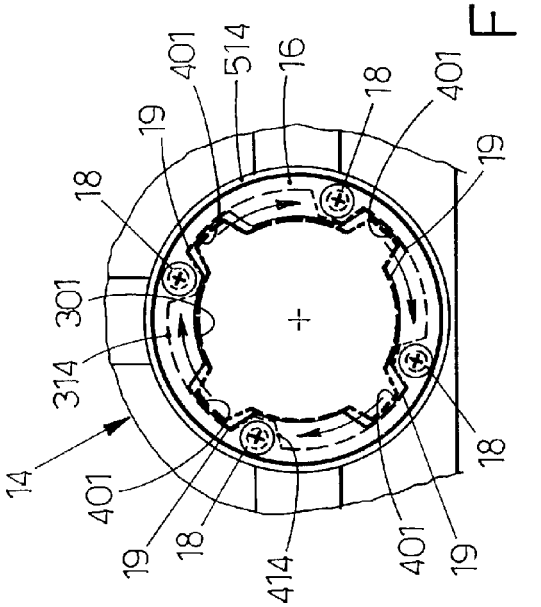

Fig.6

REFERENCES CITED IN THE DESCRIPTION

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- DE 20100577 U1 **[0002]**
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